

# The Analysis and Countermeasures Study on Oil Spills in Major World Ports

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**ABSTRACT.** *With the development of the diversity of transportation modes, maritime transportation has become one of the most commonly used ways of oil transportation in the world. However, offshore oil spill accidents are also happen frequently, and it's also one of the forms of serious marine pollution. Therefore, the marine oil spill risk assessment and accident prevention measures have gradually attracted the attention of experts in water transportation field all over the world. This paper mainly discussed the main inducement of oil spill from ships, expounds the methods of oil spill risk assessment at home and abroad, and analyzed the present key problems of oil spill risk assessment from the ship itself and human environment, and finally discussed the current countermeasures of oil spill accidents from ships in ports.*

**KEYWORDS:** *Marine transportation; Oil spilling; Major ports; Analysis*

## 1. Introduction

Since the 1960s, marine transportation industry has developed rapidly, but the ecological environment pollution caused by the increasing frequent sea transportation has also made people startling, especially the ship oil spill accidents. The rapid development of the oil industry has led to a continuous increase in the daily delivery of offshore oil transport vessels, which has led to a corresponding increase in the incidence of sudden oil spills in the world's port waters. However, the incidence of oil spill accident pollution in the sea area is not proportional to the number of oil tankers, offshore oil exploration and development and other factors.[1] It can only say that the overall oil spill accident caused by the probability of pollution of the sea is on the rise. Therefore, it is not only related to the development of marine industry but also an important measure to protect the marine environment. Therefore, to reduce the incidence of oil spill accidents at the major ports and to prevent the phenomenon of marine oil spill is not only related to the development of marine transportation industry but also an important measure to protect the global marine environment.

## 2. Main Causes and Cases Ofmarine Oil Spill Accidents

The following are typical cases of oil spill coverage:

(1) In October 2016, a container ship added fuel to a dock. During the operation, due to the failure of the staff to effectively regulate the ship's stern, the fuel storage tank overflowed and about 100 liters of fuel fell into the water.

(2) In 2014, the "Summer Wind" cargo ship collided with a fuel barge on the Houston vessel's waterway, spilling about 170,000 gallons of tar-like oil into the sea, essentially blocking all ports in Galveston Bay and seriously affecting traffic in and out of Calveston, Texas.

(3) The main cause of the oil leakage in the Gulf of Mexico in 2010 is the blockage of the pipeline by hydrate, which leads to the rupture of the pipeline.[2] The spill cost hundreds of billions dollars to its ports, and its cleanup took nearly a decade to complete.

There are many causes of oil spills on oil tankers, the most common of which are as follows:

(1) Crash: One of the frequent factors of marine oil spill accidents is the oil-spill phenomenon formed by ships colliding with offshore drilling towers, oil platforms and their ancillary facilities. According to the survey, as many as 30,000 oil installations such as oil wells and rigs on the world's continental shelf are likely to occur at any time.

(2) Natural calamities: Natural disasters such as earthquakes, windstorms and tsunamis are also the causes of oil spill accidents.

(3) Port issues: Under the background of the development of maritime transportation, the number of oil tankers in and out of the port is increasing, and the congestion of the port caused by man-made or natural factors is also a cause of the oil spill accident in the port.

### **3. Main Factors of Ship Oil Spill Accidents in Ports**

#### ***3.1 Incomplete Port Cleaning Equipment***

Marine anti-fouling system is very complicated and difficult to operate, so the decontamination link often needs many institutions to cooperate with each other, and also mainly depends on the well-functioning decontamination facilities.[3] However, although many coastal ports are currently equipped with a certain amount of decontamination facilities, the high cost of acquisition has resulted in a small amount of investment in many facilities. Although the marine oil spill contingency plan has been announced, some sea areas to achieve complete work are still somewhat difficult. In addition, many decontamination equipment needs to be updated in time after a certain period of service (3-5 years), more reserves means more wastage and less is meant to be inadequate in case of emergency. This contradiction has not been effectively resolved.

#### ***3.1 The Unsound Management System of Ships in Ports***

The practitioners in the field of shipping agree that the technical state of high quality assurance is an important basis for ensuring the safety of maritime transportation.[4] This requires that the relevant personnel strengthen the management of port ship docking. It can be said that the failure working of the safety management company in charge of ship operation to strictly comply with the relevant regulations on maritime safety and pollution prevention is an important cause of the accident.

#### ***3.3 Impact of the Service Life of the Ship Itself***

Survey data show that the ship's equipment parts and components with the increasing using age will appear varying degrees of deterioration phenomenon, and the technical condition is not good. Therefore, the more likely it is to cause marine and oil spill accidents. Once the oil spill occurs, the control ability of the oil spill is very limited, so it is difficult to restrain the potential state of oil spill spread, and then it's easy to lead to the further expansion of the scale of the ship oil spill accidents.

### **4. Main Countermeasures to the Oil Spill Accidents in Ports**

#### ***4.1 Improving Environmental Monitoring and Warning System***

The port management personnel should carry out the dynamic monitoring and managements of the marine oil pollution, and further develop a more perfect early warning system for the oil pollution in the port. [5] For example, the U.S. Institute of Environmental Sciences has developed a marine oil spill response system, while Canada uses NOAA weather satellites to monitor coastal waters in ports. Therefore, China's sea-related management departments need to strengthen the necessary monitoring, communications, patrol, transport management and other supervisions, and the installation of sound alarm devices. The relevant port management departments should optimize the means of monitoring at night and under low visibility conditions, especially large hub ports. The competent departments should set up a monitoring center for ship port sewage discharge, form a systematic monitoring network, and improve the reporting and reward system, so as to strengthen the monitoring of ship operation site sewage discharge, so that the pollution accidents in coastal port waters can be monitored and dealt with in a timely and effective manner[6].

#### ***4.2 Strengthening the Routine Maintenance of Ship Hardware***

The oil tanker is the main type of ship oil spill accident, so the operation of single shell ship should be eliminated as soon as possible. As early as 2009, China has announced the implementation plan for the

elimination of domestic single-shell oil tankers, and the implementation of this scheme has also reduced the incidence of ship oil spill accidents to a certain extent. In addition, the relevant departments also need to regularly use safety inspection means to repair the technical status of the ship to ensure that the ship can be strictly in accordance with the regulations to get the necessary maintenance. Meanwhile, regulators should strengthen the usual management of old ships. Except daily maintenance, in order to avoid the existence of safety risks of ships are still in operation, the mandatory scrapping system should be strictly enforced.

#### ***4.3 Implementing Risk Assessment Scheme for Ship Inbound***

Ship oil spill risk assessment scheme is a comprehensive monitoring and evaluating method, which aims to maintain the stability of the marine ecological environment, and to follow the principle of early warning and take appropriate measures to reduce or eliminate the harm. It uses data acquisition and model operation to predict and evaluate the possible cause and influence trend of ship oil leakage. Under this kind of mechanism, the staff can monitor the port ships effectively, reducing the incidence of oil spills. UK first introduced the International Oil Pollution Prevention Protocol in 1954 (OILPOL 54), but its normative effect is not very clear. In the oil spill on the tanker Torrey Canyon in 1967, awareness of the severity of the ship's oil spill emerged.

In the aspect of oil spill prediction, probability theory and artificial deity are adopted. The probability of oil spill accident is simulated and forecast effectively by network method, analytic hierarchy process method and grey theory method. These assessment methods also different in their use fields:

(1) According to the detailed historical data, the probability theory and artificial neural nets mainly analyzes the oil spill accident in the port area, collates the accident mathematical regular pattern, and then predicts the oil spill accident in the port [7].

(2) Analytic hierarchy process (AHP) is to analyze the influence of the factors that caused the oil spill accident on the degree of the event, establish a prediction model, and predict the possibility of the ship's oil spill.

(3) The multi-level grey system only analyzes the oil spill results, and does not consider the influencing factors of the oil spill accident. It relies on the establishment of prediction models to predict oil spill events in port waters.

At the same time, it is important to pay attention not only to the accident evaluation and early warning of ships inbound and outbound the port, but also to the oil supply step when the ship stops at port.

Taking the Myanmar port as an example, the Yangon river channel belongs to the inland waterway, which is the main channel for the ships in and out of Myanmar port. [8] The Thilawa Port Area is located 8.6 nautical miles downstream of the Old Port District of Yangon. It is located in the hinterland of Thanlyin-Kyauktan Special Industrial Park at the outer end of Yangon. As one of the main ports of coastal and international transport, the port of Thilawa attaches great importance to the operation of ships when they are docked and departed. Relevant departments adopt fuzzy comprehensive evaluation method to evaluate the safety of Yangon River Channel. This comprehensive evaluation can estimate the navigation conditions of the waterway under the influence of different environmental factors, so as to ensure the safety of ship navigation and effectively prevent ship traffic accidents and oil spills from ships.

#### **5. Conclusion**

The current goal of global economic development should follow the concept of sustainable development, and marine environmental protection and economic sustainable development should coordinate and restrict each other. Therefore, it's necessary for the relevant personnel to accurately analyze the causes of the ship oil spills in major ports, in order to make a correct assessment of the harm degree of the oil spill accident, and then to achieve a certain prevention and judgment goal. At present, depending on science and technological ways, the assessment methods on ship oil spill has made some progress, but the inducement of oil spill accident is uncertain, and the theoretical system of accident risk assessment has not been formed completely, so it's necessary for relevant personnel to continue the research.

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